UNITED
NATIONS

E

Economic and Social
Council

Dist.
GENERAL

E/CN.16/1995/2
20 February 1995

Original: ENGLISH

COMMISSION ON SCIENCE AND TECHNOLOGY
FOR DEVELOPMENT
Second session
Geneva, 15 May 1995
Item 2(a) of the provisional agenda

SUBSTANTIVE THEMES: (a) TECHNOLOGY FOR SMALL-SCALE ECONOMIC ACTIVITIES TO ADDRESS THE BASIC NEEDS OF LOW-INCOME POPULATIONS

Science and technology for basic needs: a bridge

Report of the Panel

Pursuant to Economic and Social Council resolution 1993/74, the Panel on Technology for Small-scale Economic Activities to Address the Basic Needs of Low-income Populations has completed its work. The report of the Panel is submitted to the Commission for its consideration.

GE.95-50555

CONTENTS

		Paragraphs
EXECUTIVE SUMMARY		1-3
INTRODUCTION		4-5
I.	BACKGROUND	6-8
	A. Origin of the Panel	6
	B. Focus of the Panel's work	7
	C. Method of work	8
II.	BASIC NEEDS IN A CHANGING LANDSCAPE	9-17
	A. Concept	9
	B. Current developments	10-11
	C. Poverty, income polarization and technological progress	12-17
III.	TECHNOLOGY-RELATED APPROACHES FOR SATISFYING BASIC NEEDS	18-29
	A. The informal sector	19-20
	B. Alternative technologies	21-23
	C. Technology pragmatism	24
	D. Recent experiences	25-29
IV.	CONCLUSIONS AND RECOMMENDATIONS	30-46
	A. Conclusions and recommendations for the six "pillars"	30-45
	B. Summary recommendations for action	46

ANNEXES

I. List of participants in the Panel on Technology for Small-scale Economic Activities to Address the Basic Needs of Low-income Populations

II. Experts having contributed to the work of the Panel as "Friends of the Chairman"

EXECUTIVE SUMMARY

1. Technological progress has been responsible for vast improvements in the physical conditions and living standards of the majority of the world's population. While, technologically, the world has never been in a better position to improve the conditions of the very poor, roughly 20 per cent of the world's population has not benefited materially from advances in technology. Their basic needs remain a most critical problem. The Panel on Technology for Basic Needs is seeking to refocus the world's attention on this grave question. It has defined basic needs as those minimal requirements needed for sustaining life of all the people, and encompassing adequate nutrition, health care, water and sanitary facilities, and implying access to education and information enabling individuals and communities to participate in productive activities and rationally use the basic goods and services available. The Panel agreed that priority should be given to technology strategies, approaches and policies, rather than specific technologies, and a pragmatic and pluralistic approach investigating the potential of diverse types of technologies. In reviewing experience with basic needs programmes, as well as relevant work on technology and basic needs carried out within the United Nations system, it was found that scant attention had been given to the role of technology in alleviating poverty. One problem was a failure to replicate successful cases sufficiently, and instigate a systematic effort geared to the application of technology to basic needs. Nevertheless, it was found that those nations which had launched determined and protracted campaigns to provide basic needs were, in a number of cases, able to demonstrate progress.

2. The fundamental objective of the technological facet of meeting basic needs was defined as follows: creating participatory conditions that increase the ability of the poor to generate, access, comprehend and creatively use technologies in order to satisfy their basic needs. The Panel emphasized the importance of six bridging elements or "pillars" linking technology to basic needs satisfaction and elaborated specific recommendations. The six complementary bridging elements are: (a) education; (b) access to information; (c) participation; (d) health; (e) basic infrastructure; and (f) small-scale economic activities. Special recommendations for action were formulated for science and technology policy for basic needs.

3. Among the recommendations are: the promotion of a conference to sensitize the scientific and technological community and policy- and decision-makers to the issue of science and technology for basic needs; periodic reviews of basic needs programmes by decision- makers; the monitoring of basic needs indicators and the implementation of a mechanism for evaluating country science and technology policies in terms of how adequately basic needs satisfaction is being addressed; a "one stop" referral service to information networks and the strengthening of networking of science and technology institutions and enterprises of both private and public sectors, at national and international levels; the promotion of programmes for financial delivery to micro/small and medium-sized enterprises; the launching of a pilot programme involving different countries from different regions, to report to the Commission. Finally, it is recommended that technology for basic needs be addressed in a series of sessions involving the Commission, as well as in a joint session of the Commission with the Commission on Human Rights.

INTRODUCTION

4. The concern with technology for basic needs is motivated by the grave and widening fissure between the very poor, representing approximately 20 per cent of the world's population, and the remaining majority. Closely associated with this growing gulf is the serious discontinuity—and one that is also becoming more severe—between the day-to-day existence of those living with basic needs deficiencies and the corpus of scientific and technological knowledge as well as the concerned global scientific and technological community. The perception of a chasm, fracture or rupture was the primary inspiration for the "bridge" metaphor in the title of the report. The predominant theme throughout is the

devising of bridging mechanisms between the very poor and the technology access that is enjoyed by the majority of the planet's population not plagued with basic needs deprivation. The bridge, as elaborated below, is comprised of six complementary elements: education, access to information, participation, health, basic infrastructure, and small-scale economic activities. These bridging elements, or pillars, are founded on science and technology (S&T) policy for basic needs satisfaction.

5. The problem of unmet basic needs is intimately connected with other worrisome facets of the human condition. One pertains to the fact that the majority of the world's very poor are either women, or children and the elderly who are ordinarily dependent on the care of women. This is a telling symptom of fissures along gender lines. Similarly, there is a disarticulation between humanity and nature that is leading to mounting ecological and environmental problems, some of which affect regions far beyond the countries where the problems originate. Once again, the question of basic needs is relevant since some of the most egregious ecological degradation is associated with regions characterized by extreme poverty. Patently, sustainable human development is not compatible with these widening gulfs; fashioning, maintaining and improving adequate bridges is a prerequisite to long-run improvement of the human condition. The bridge emphasized in this report, namely between science and technology and basic needs, is closely associated with, and complementary to, measures designed to resolve gender and environment-related difficulties.

I. BACKGROUND

A. Origin of the Panel

6. The Commission on Science and Technology for Development, at its first session in April 1993, identified, as one of the themes for its inter-sessional work, the issue of technology for small-scale economic activities, to address the basic needs of low-income populations. In pursuance of Economic and Social Council decision 1993/320, the Commission established a panel of its own members to be responsible for preparing a draft report on this issue for consideration by the Commission as a whole, at its next session. Additionally, resolution 1993/74 of the Council on the future work plan of the Commission indicated that, when examining the above theme, the Panel should build upon relevant studies from inside and outside the United Nations system, including the regional commissions, the United Nations Conference on Trade and Development (UNCTAD), the United Nations Industrial Development Organization (UNIDO), the International Labour Organisation (ILO), the Food and Agriculture Organization of the United Nations (FAO), the World Bank and the regional development banks.

B. Focus of the Panel's work

7. At its first meeting, the Panel defined its task as a review of technology in relation to basic needs, and discussed how fresh approaches to science and technology could ensure that the basic needs of low-income populations were met. Following the suggestions made by the Bureau of the Commission, the Panel decided that its work would focus on food production and processing, education—especially technical and vocational training—and health care. The Panel agreed that technology strategies, approaches and policies, rather than specific technologies, should be given priority in the course of its work programme and that, in accordance with Economic and Social Council resolution 1993/74, emphasis should be given to dissemination mechanisms, including training, regional and international cooperation as well as capacity-building and research and development activities.

C. Method of work

8. The Panel on Technology for Small-scale Economic Activities to Address the Basic Needs of Low-income Populations held a total of three sessions: from 2 to 3 June and 17 to 18 October 1994 and 18 to 20 January 1995. The Panel is comprised of representatives from countries members of the Commission on Science

and Technology for Development and who had indicated an interest. Mr. Arnoldo Ventura, a member of the Commission, Special Adviser to the Prime Minister on Science and Technology, Jamaica, was elected Chairman of the Panel. Representatives of a number of international organizations also participated in the deliberations of the Panel (see annex I). The Panel's work has been based on inputs from its members, international organizations, and issue papers prepared by international consultants. At the request of the Panel, the UNCTAD secretariat undertook a review of the work of the United Nations system and selected organizations dealing with technologies for basic needs.[1] This material, together with the exchange of views and deliberations at meetings of the Panel, has served as the basis for the present report. The Panel wished to record its gratitude for the generous contribution of the Government of the Netherlands to its work. It also recognized the valuable support of the experts who acted as "Friends of the Chairman" (see annex II).

II. BASIC NEEDS IN A CHANGING LANDSCAPE

A. Concept

9. Basic needs have been defined in different ways, but a representative perception of the concept is that of Frances Stewart who sees the approach as "one which gives priority to meeting the basic needs of all of the people. The actual content of basic needs have been variously defined: they always include the fulfilment of certain standards of nutrition (food and water), and the universal provision of health and education services. They sometimes also cover other material needs, such as shelter and clothing, and non-material needs such as employment, participation and political liberty."[2] A review of literature and case studies has divulged that a considerable amount of work has been devoted to the basic needs issue, but the dominant themes concerned attempts to identify and quantify features of basic needs and evaluate programmes designed to meet them. The studies concentrated on methodological and statistical aspects of basic needs, such as elaborating on specific country, regional or sectoral data; identifying population segments lacking goods and services; outlining the characteristics of basic needs, searching for indicators to measure the extent of those needs, and attempting to define common grounds and understanding which could help in formulating targeted policies; evaluating countries' performance in meeting basic needs. The role of technology, its application and diffusion, and its policy-related aspects with respect to basic needs was scarcely reflected in this material.

B. Current developments

10. We live on a planet that has experienced sweeping technological, economic, political and social change, over the past two decades. This has affected the fundamental nature of the problem of poverty and, to a great extent, impinges on the possibility of realizing sustainable human development. Politically, there are shifts in the distribution of power both within and among nations. Countries in transition to a market economy are seeking to redirect the emphasis of resources for science and technology.[3] Although there are potent interactions and feedback mechanisms operating among these facets in the new landscape, technological change is the primary driving force. Economically, it is changing the structure of production all over the world and, in consequence, affecting comparative advantages, international division of labour, income levels, productivity, employment, skill profiles and patterns of international commerce, among other economic variables. With microelectronic innovations in the vanguard, and modern biotechnology and new materials science rapidly coming on stream, new emerging technologies are affecting the human condition and prospects profoundly. These emerging technologies are more mobile, flexible and knowledge-intensive than ever-before, but at the same time less energy- and resource-intensive. Also, while technology transfer remains important, it is now subordinated to the desire to accumulate more domestic technological capabilities, an aspect which did not carry quite the same weight in earlier basic-needs related programmes.

11. In the new global economic panorama, a transfiguration has led virtually every country to make some move towards deregulating its domestic economy and liberalizing its trade regime; many nations have accomplished drastic shifts towards more market-oriented, outward-looking economic systems; the ability to become competitive domestically and internationally is all-compelling. On the world political scene, there has been a significant movement in the direction of democratization and assertion of human rights which present new avenues and opportunities for formulating policies directed at basic needs satisfaction. Along with a tendency to decentralize political control, democracy signals a more propitious atmosphere for widening and deepening participatory behaviour which embraces poor populations. Moreover it has created a more favourable climate for linking basic needs satisfaction to human rights. Taken together, economic liberalization and political democratization point to reduced reliance on paternalistic, top-down approaches in favour of policies encouraging broader participation by key actors, including the poor. Closely related to this are the current political contours which encourage decentralized decisions and problem solving, a trend laden with both challenges and opportunities for effectively broaching the subject of deficiencies in basic needs satisfaction.

C. Poverty, income polarization and technological progress

12. Over the past several decades, technological progress, supported by the new economic and political arrangements, has been responsible for vast improvements in the physical conditions and living standards of the majority of the world's population. This trend can be substantiated by examining indicators such as rising per capita income, life expectancy and infant mortality. For millions, technological progress has satisfactorily resolved the basic needs problem. While technologically the world has never been in a better position to improve the conditions of very poor populations, roughly 20 per cent of the world's population has not benefited materially from advances in technology.

13. In many parts of the world the poor, especially poor women, are losing ground in terms of income and amenities relative to the remainder of the population. During the period 1980 to 1991, the least developed countries experienced a rate of growth in per capita income of 0.7 per cent in contrast to a rate of 2.1 per cent by developed market economies. Meanwhile, their per capita food production actually declined between 1980 and 1992, at an annual rate of 1.2 per cent.[4] The World Food Council estimated that in 1992 there were 550 million hungry people in the world, a number which jumps to around one billion when those vulnerable to periods of hunger each year are included.[5] In 1981 average per capita output in developed countries was about 20 times greater than in developing countries; by 1991, the ratio had expanded to 22 to 1.[6] Looking at the polarization problem somewhat differently, ECLAC estimated that in 1960 the world's highest income quintile received average incomes 30 times higher than the population in the lowest quintile; in 1990 the disparity had grown to 60 times greater. The same organization estimates that 45.9 per cent of Latin America's population is below the poverty line, an increase of 2.5 per cent since 1986; 22 per cent are in extreme poverty.[7] The World Bank estimates that the number of people living on less than one United States dollar per day (1985 prices) rose from 1.051 million in 1985 to 1.133 million in 1990.[8] In a news release following the recent IMF-World Bank Summit in Madrid, the World Bank's President, Lewis Preston, pointed out that in the next generation there will be 3 billion more people with desperate needs for clean water, sanitation, electricity and other basic needs. By no means is income polarization confined to the South. The United States Congressional Budget Office reported that between 1949 and 1989, the lowest quintile saw a decrease of 10 per cent in real income whereas the highest 1 per cent increased their income by 105 per cent.[9]

14. These conditions have contributed to a greater marginalization of poor populations and a feeling of alienation and hopelessness. The term "marginalization" is intended to convey that the poor are excluded and have no route through which they can influence the distribution of power or resources in ways that might be beneficial to them. It does not imply that they have no visibility or influence on the lives of the non-poor. The basic needs problem

means that, directly or indirectly, populations that are not impoverished are subjected to a variety of detrimental impacts. They suffer a heightened sense of insecurity, run higher health risks, incur increasing expenses for personal protection and are subjected to relatively higher tax levels. In many of the world's nations, partly owing to technological advances coupled with a greater emphasis on competitiveness, the middle class and elites already suffer from less job security amid growing anxieties, augmented in view of the increasing violence and criminality of those with basic needs deficiency.

15. In the experiences of three least developed countries[10]—Ethiopia, Togo and Uganda—the problem of extreme poverty appears as the most dramatic feature. In Ethiopia, for example, almost 51 per cent of the population lives below the absolute poverty line. Other salient aspects found in these countries were the predominantly rural population and the extremely high proportion of youth under 15 years of age, resulting in a high level of dependency in the total population. The overwhelming majority of the economically active population in the rural areas and a great portion in the urban sector is made up of self-employed workers. Health coverage, sanitary conditions and, accordingly, life expectancy, are low, as are education facilities. Consideration of these aspects is fundamental to formulating a strategy for technology aimed at the satisfaction of basic needs, which is seen as almost synonymous with formulating national economic development objectives in general.

16. Previous models for attacking the basic needs situation have become inadequate; there has been a "sea change" in important facets of the human condition that renders earlier models at least partially obsolete. Those denied the possibility of meeting their basic needs are fiercely expressing their social discontent. Increasingly, their situation presents the greatest challenge for socioeconomic development, and has acquired environmental and national security dimensions. The Jamaican case[11] demonstrated clearly that "an assertive attack on the basic needs problem goes far beyond the traditional poverty alleviation strategies tried unsuccessfully in the past. A local basic needs approach calls for a greater emphasis on domestic technological competence and management, a greater absorptive capacity of the benefits of S&T among those most in need, and a wider spread of the fruits of growth through decentralized production and consumption..., as well as popular participation...."

17. Deleterious poverty-related effects are no longer compartmentalized within poor countries and, putting it bluntly, the extreme poverty is adversely affecting the quality of life of all the world's population. The spirals of less security and more expenses; of cultural, ethnic, religious and social fractures; and of North to South interventions, are not sustainable. This is the primary reason why a fresh strategy is being sought for solving basic needs deficiencies, consonant with the new technological, economic, political and social realities. Several other factors of paramount importance also figure in this context: first, and absolutely central to the discussion, market forces can be and should be constructively and imaginatively employed in ameliorating abject poverty; however, for improving the conditions of the very poorest segments of society, extra-market interventions are a prerequisite. In achieving the goal stated above (in paragraph 2), a fundamental condition is the fashioning of avenues, bridges or linkages through which the poor can breach the expanding knowledge and technology gap that perpetuates their economic, political and socio-cultural marginalization; secondly, the focus must be aimed at and maintained squarely on human beings — "things" such as technology and knowledge are important, but only as they relate to human beings and how they are deployed and manipulated for the betterment of the human condition and further sustainable human development; thirdly, the process of combating basic needs deficits is value-laden: ethical and attitudinal considerations influence the chances for, and the extent of, succeeding. A primary ethical element is the challenge to the global science and technology community to recognize that, by having the capacity to make significant contributions to resolving basic needs problems, with this capacity comes an associated responsibility and moral obligation. As regards attitudes, the battle will entail moving from passivity, a sense of inferiority and a feeling of helplessness to active participation, with confidence based on

collective and individual achievements and justifiable hope. These and perhaps other matters of value will interact powerfully with access to and deployment and use of science and technology for poverty alleviation.[12]

III. TECHNOLOGY-RELATED APPROACHES FOR SATISFYING BASIC NEEDS

18. There follows a brief examination of three technology-related approaches to solving basic needs' shortfalls. First, a review of experience in the informal sector indicates that a substantial number of micro-scale and small enterprises are capable of undertaking technical innovations. Secondly, two alternative levels, appropriate technology and technology blends, are singled out for review since both are explicitly dedicated to raising the living conditions of the poor. Thirdly, there is an appeal for the employment of "technological pragmatism", an approach that does not automatically exclude any level of technological sophistication that might contribute to the cause of diminishing basic needs' deficiencies. Finally, in view of the discussion, case studies are presented that illustrate a variety of experiences regarding the application of technology for basic needs.

A. The informal sector

19. Traditionally, the informal sector has been associated with strategies for meeting basic needs because of three important factors: (a) its role as producer and supplier of basic goods and services at prices which could be afforded by the poorer section of the population; (b) its capacity to absorb the rapidly growing urban labour force and generate income that enables the urban poor to satisfy its basic needs; and (c) its application of technologies appropriate to local factor endowment. These characteristics, coupled with easy entry into the sector, its size, structure and capability to adapt to changes, render the informal sector one of the most important components of any basic needs' strategy. The informal sector, particularly in urban areas, has recently been expanding and proliferating. In some cases, especially where major trade and industrial policy reforms have resulted in the contraction of the formal sector, they are providing the majority of urban jobs and supplying goods and services essential to the poor. In African countries in particular, informal sector activities now employ more people than the formal sector and provide higher incomes than do rural sector activities.

20. Concerning technologies for basic needs, the key question is whether the technologies used in the informal sector are conducive to basic needs' satisfaction and, more importantly, whether the sector has the potential to undertake technological upgrading.[13] A collection of studies on the technological capabilities of Third World informal sector enterprises in metal-engineering activities reveals that some firms are capable of accumulation of capital, upgrading of equipment to successively more sophisticated levels, self-construction of hand-operated equipment or tools, development of new product designs, improvement of product quality, inputs of new materials, investments in human capital, and, in some cases, production of capital goods required by other informal sector enterprises.[14] A review of the literature has uncovered considerable corroborative evidence of the innovative abilities of micro and small enterprises, many of which are in the formal sector.[15] Despite some major handicaps, the informal sector also is able to exhibit innovative behaviour, which implies that, under more favourable conditions, technological progress in the sector could be more robust and the rate of "graduation" to the formal sector, a rate now quite low, could be accelerated.

B. Alternative technologies

21. Although they cannot be defined in water-tight compartments, several levels of technological sophistication can be distinguished. Traditional technologies are those employed over an extensive period of time and which tend to be well-adapted to local culture and habits. Conventional technologies are those which have proved to be commercially viable with progress resting mainly on engineering

innovations and scaling up for larger markets. Emerging technologies are relatively new and primarily science-driven. In addition to these levels of technological sophistication, there are two other technological "alternatives", namely (a) intermediate or appropriate technology and (b) technology blends.

22. Intermediate technology, later designated appropriate technology, was popularized in the early 1970s as being a technological level somewhere between traditional and modern (conventional and emerging) technologies.[16] There is no universally accepted definition of appropriate technology, but usually, compared to modern technologies, it is characterized by all or most of the following attributes: it is labour-intensive; its productivity is on smaller scales; it is ecologically "friendly"; it requires less demanding worker and managerial skills; it utilizes more local inputs; it requires a lower investment per job created. Appropriate technology has been criticized for not accomplishing enough to benefit the poor. Its application had a checkered record in the early days and, all too often, successes were very geographically circumscribed or confined to a single application; any spread to alternative uses and the development of complementary innovations was not always in evidence. Yet, appropriate technology might well be a valuable tool for combating extreme poverty; high-impact appropriate technologies include: systems for delivering micro-loans like those inspired by Bangladesh's Grameen Bank; bamboo tube wells in southern Asia; improved cookstoves in China. Furthermore, appropriate technology had been hampered by a disinclination to commercialize the venture and a tendency to connect such technology with a subjective vision of a proper life-style rather than to the effectiveness of technology. For organizations promoting technological development in developing countries, such as the Intermediate Technology Development Group, Volunteers for International Technical Assistance, and scores of other agencies, these shortcomings appear to have been largely overcome. It is suggested that the sizeable and growing arsenal of appropriate technologies should be taken seriously in any process of screening and selecting technologies for poverty-related projects.

23. Another technology-related approach, technology blends, began to be investigated about a decade later. Technology blending, as it is now customarily known, entails the constructive integration of emerging technology into low-income, small-scale economic activities in developing countries, with the important proviso that, as the word "blending" implies, the introduction of the emerging technology should blend with and preserve at least some of the prevailing traditional production techniques.[17] The original impetus for investigating technology blending came from the former United Nations Advisory Committee on Science and Technology and a small but growing literature has resulted.[18] The literature includes cases in which modern biotechnology, laser technology, new materials sciences, microelectronics innovations, satellite communications and photovoltaic power have been blended with such traditional economic activities as small-holder agriculture, agribusiness, service delivery systems for the poor, informal urban enterprises, and small- and medium-sized manufacturing.[19] As expected, some technology blending efforts have run into difficulties and some involve trade-offs between gains and losses in meeting various goals; however, the incidence of clear-cut successes would appear to warrant more vigorous experimentation and increased efforts to alert the scientific and technological community to them, as well as calling the attention of developing country decision-makers to the potential benefits flowing from a marriage of indigenous and high technology.

C. Technology pragmatism

24. While appropriate technology and technology blending were singled out for discussions, as these levels of technologies are expressly geared toward bettering the lot of the poor, it should be stressed that the application of conventional and emerging technologies can, under the proper conditions, yield gains in providing goods and services for satisfying basic needs. Very high technologies were involved in developing oral rehydration salts; sophisticated computer techniques were employed to develop wind-powered electricity generation for developing countries and likewise to get the correct degree of porosity for

small dams in India; and frontier technology was applied to developing an environmentally friendly brick-firing kiln for small brick producers in Mexico. Whether these and similar technological advances constitute examples of appropriate technology, technology blends or emerging technology is considerably less important than the fact that they work effectively. What seems called for is a multi-layered technological approach, that is, "technological pluralism". This rests on the more fundamental principle of "technology pragmatism"—an eclectic search for the best technological means to satisfy basic needs, given the prevailing set of constraints and opportunities inherent in each situation.

D. Recent experiences

25. A few selected cases are summarized below. They illustrate some of the efforts undertaken by developing countries to tackle basic needs satisfaction, dwelling in particular on technology dissemination and commercialization, on the correlation between education and nutrition, and between human resource development and technology adaptation, innovation and R&D.

26. In connection with the advent of the "green revolution" during the 1960s and 1970s, an interesting case is that of the Punjab, an Indian agrarian state. The "green revolution" increased yields and brought overall prosperity to rural workers.[20] Despite their limited land base, marginal and small farmers of the Punjab were able to record almost as much total crop output and farm business income per acre as their larger counterparts, primarily because of a much higher cropping intensity through a rational year-round use of their family labour, implying a highly skilled use of techniques and resources. The Punjab case shows that agricultural and industrial development and the application of technology are best viewed as interlinked and supportive: the growth of agricultural productivity was based on the application of science and the introduction of modern industrial inputs, for example, fertilizers and capital goods, and irrigation facilities. In this case, the Government of India played a major role in organizing the provision of necessary agricultural inputs to the individual farmers through credit facilities made available by state-supported cooperative societies, as well as the necessary infrastructural framework— roads, markets, the agricultural university and agricultural extension services.

27. Technology commercialization and diffusion are taken up in detail in a recent volume which concentrates on how to transform the Indian rural economy.[21] An overview of the various cases presented reveals that in developing countries the large percentage of the population living below the poverty line does not have the purchasing power to articulate its demands through the market; neither can the market alone channel goods and services to a population basically engaged in subsistence production.[22] The study stresses the magnitude of the technology gap between rural and non-rural sectors and the low agricultural productivity levels which reflect low technological levels. Technological diffusion in the Indian rural sector has also been hindered by lack of qualified skills, largely owing to the so-called "rural skill drain". Another factor is the lack of adequate research and development projects designed to improve rural technology. However, some of the limitations suffered by the small-scale producer in the rural sector - such as limited access to credit, information, services and infrastructure - have been overcome by combining traditional and modern elements of technology, through the so-called technology blending process, including initiatives at down-scaling of modern technology to suit different levels of scale, energy and modes of production.[23] Finally, the importance of a suitable macroeconomic policy environment is stressed. Such policy is essential in order to generate demands for improved technologies that respond to rural sector requirements.

28. Other experiences have been reflected, for example, in case-studies on Mexico[24] and on Ecuador.[25] The case of Mexico points to the strong correlation between educational levels and under-nourishment, and to the differences between urban and rural sectors. For example, 41 per cent of the heads of households in the malnourished groups had no formal education at all, and around half of them were economically active in agricultural tasks. The case-study of Ecuador

provides elements for analysing the performance in meeting basic needs during the 1970s and up to 1982; it includes recommendations for improving backward and forward linkages between agriculture and industry, and for specialized industrial development to provide fertilizers and appropriate machinery to foster agricultural development. Such development is critical for overcoming the input supply bottlenecks of agro-industries and of food-processing industries, which also suffer from a general lack of inter-industry integration. Rural industry is a recognized important employment generator, but lacks major technological development and faces infrastructural and marketing problems. This case-study also points out that, in many consumer industries, linking up with various technological levels will be necessary if the objectives of employment-creation, income-generation and reduction of overall production deficits are to be satisfied simultaneously; too much emphasis on small-scale labour-intensive industry may imply the sacrifice of growth objectives.[26] The study proposes a selective type of import-substitution policy based on a criterion of meeting basic needs; such selective policy must not discriminate against potential export industries. Finally, the role of income redistribution policy in respect of low-income groups is stressed, and particularly its importance in expanding the domestic market.

29. An analysis of the educational characteristics of technology innovators in the small metalworks industry in Peru shows the importance of training for technology adaptation and innovation.[27] Of a group of 13 successful entrepreneurs engaged in activities connected with adaptation and innovation, nearly two-thirds (61 per cent) had followed university studies for an average of about five years. Seven of them had followed courses or technical careers for an average of two years. Only one of the entrepreneurs had not benefited from university or higher level technical studies although he had attended a particular secondary school which had offered technical components in its curricula. The study also showed that the majority of these entrepreneurs had previous working experience in the same field; the author considers that such working experience also constitutes a form of training. In the area of research and development and in technological dissemination, an important experience is reflected in the case of the transfer and adaptation of a technology for milk substitution in the Andean Group.[28] On the basis of multidisciplinary and multinational team work, several technological alternatives could be developed to solve critical nutritional problems of developing regions. The experience proved that research and development of new, low-cost products for meeting the pressing needs of the majority of the population should be directed towards solving clearly identified problems, include studies of the characteristics of the economic sector and the consumers to be served, and be supplemented by activities aimed at promoting the market for the resulting products.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions and recommendations for the six "pillars"

30. The experiences reviewed showed diversity in technology choice, economic policy orientation and the interaction among the main actors in the society. The experiences of "good performers" suggest that success in meeting basic needs is intrinsically related to, *inter alia*: significant investment in education and health; clear priorities including the targeting of the "right groups". In line with this, the promotion of technology generation, research and development (R&D) and the diffusion and wider application of R&D results, the development of infrastructure and support services, the development of adequate delivery systems, and a favourable macroeconomic environment, are all contributing factors.

31. The review of trends and experiences also indicated that, while the satisfaction of basic needs of the bulk of the population in the developing countries is far from being met, and indeed, in some cases, has deteriorated, this objective holds a key position in the development efforts of many countries. However, the role that technologies play in satisfying basic needs has so far

received only limited attention. In looking forward, therefore, it is vital that satisfaction of basic needs be examined together with the role of technologies in production and services, including the contribution that new technologies can make to upgrading production processes and the knowledge base of skills, all of which appear to favour pluralistic and pragmatic approaches to technology. From a policy point of view, diverse case-studies examined during preparation of this report not only call for the improvement of technology, its development and diffusion, but underline the need for "new institutional blends" that will promote basic needs satisfaction. These include diverse forms of partnerships among governmental, non-governmental and private sector entities, including the scientific/technological research *cum* teaching institutions. The importance is stressed of a suitable macroeconomic policy environment, embracing industrial and trade policies, investment approaches and price policies to ensure favourable terms of trade for rural sectors. In addition, the need for specific technology policies for improving the competitiveness of small enterprises, promoting technological improvements, upgrading the quality of products, and ensuring adequate quality control is also emphasized. In these efforts, human development programmes are considered crucial.

32. Six integrating themes were identified as a focus for grouping recommendations. These were considered as main "pillars" in the effort to tackle the question of basic needs fulfilment resting on a sound science and technology policy foundation. The pillars are: (a) education, (b) information, (c) participation, (d) health, (e) basic infrastructure, and (f) small-scale activities.

Education

33. Education is an area where economic gains from meeting basic needs are most distinct. Investment in primary education in developing countries has very high rates of return, both for society and for the individual.[29] These monetary returns do not take directly into account mutually reinforcing non-monetary returns especially pronounced with respect to the education of women, such as reduced child mortality, altered fertility patterns and better human development in general.[30] Differences in educational attainment are extremely important in explaining differences in income.[31] Donors and nations suffering serious basic needs deprivation could make the provision of quality education a cornerstone of their basic needs strategy.

34. The concept of "education" as used here has connotations that go beyond those traditionally ascribed to the term, that is, almost exclusively the process of formal education. Education for increasing the capacity of the poor to gain access to and understand technology must create the instruments that are indispensable for progress. To this end the following objectives are suggested: (a) education for increasing production and productivity of small-scale economic activities; (b) education enabling the poor to participate effectively and constructively in community life; (c) education enabling the poor to put into practice policies and programmes of preventive medicine, indispensable for improving the levels of health and nutrition; and (d) education for the poor that will give impetus to a process of sustainable development, that is, one that will preserve and protect the environment. Accordingly, education expenditures and curricula should be carefully reviewed and evaluated in terms of these objectives. Nations with significant shortfalls in meeting basic needs would benefit from undertaking a review of the composition of their education expenditures in terms of primary, secondary and higher education, and the geographic configuration of these expenditures. Thus they could determine whether the composition and pattern of investment in education is consonant with optimal social returns and basic needs objectives. In reviewing their school curricula, careful attention should be devoted to seeing that students are taught science in a manner that is meaningful and that they are exposed to techniques of production relevant to future income-generating activities. Countries should be cognizant of new effective technologies for assisting the process of education that involve computer networking and other micro-electronics-based tools for learning.

35. Technical assistance and extension services for micro and small enterprises (MSEs) can reach the poor through delivery systems that function well.[32] Careful comprehensive surveys could be made of existing programmes for supporting technical improvement of small enterprises and those that seem best suited to the circumstances adopted. International agencies can furnish the raw material, for example, through evaluative case-studies. Such surveys have been initiated by specialized United Nations agencies, for example the International Labour Organisation, in the case of a delivery system for Ghana. International financial institutions and non-governmental organizations can play an important role (c.f. biovillage experiments cited in footnote 32).

36. Clearly overall responsibility for providing education to the very poor rests with national Governments, although regional and local levels can make valuable contributions, not the least by making suitable adjustments for local circumstances. As to training, private and public sector partnerships may well be practicable also. Donors and education administrators should possibly give first priority to the teaching of teachers and the training of trainers rather than to the building of new schools. Decision-makers in countries with a deep low-income social strata and, in fact, the entire global scientific community must become more aware and more sensitive to the potential contributions which science and technology can make to improving the income, productivity and quality of life of the very poor. This is of the utmost importance. An effort needs to be launched and vested with sufficient international prestige and publicity to galvanize further actions aimed at rechannelling, to some extent, the direction of the world's scientific and technological undertakings.

Access to information

37. Information is an essential pillar for employing technologies for the provision of basic needs. Students and teachers in low-income communities, striving to keep abreast of the changing economic, political, social and technical configurations that affect their lives, require access to information. It is basic for activities geared to participatory action and movements to gain empowerment for poor populations. It is extremely useful
for smaller enterprises attempting to gain knowledge concerning how to go about applying for credit, possible product diversification, market conditions for their product, product specifications established by state regulations or by buyers, price and availability of inputs, transportation alternatives and schedules, and alternative techniques of production. Decision-makers must also be able to find out the extent to which resources intended to alleviate basic needs deficiencies are "hijacked" by income strata that are not really in dire need: programmes designed to alleviate poverty could be periodically reviewed so as to determine whether the targeted group is actually benefiting. While this is a national matter, non-governmental organizations are strategically placed to provide information on how much benefit is being reaped by the very poor.

38. There is a rich variety of media for sources of information that includes printed matter, telephones, radios, personal contact, and computers, for example. The central idea is to use all information avenues that are practical in the effort to increase the poor's exposure to information that is comprehendible and useful. As in the cases of education and small-scale economic activities, the scientific and technological community can be of great value by initiating participatory explorations with targeted groups to identify and facilitate access to such information. The information needs to be structured and intelligible to poor populations; the flows should not be unidirectional. The international community, donors, non-governmental organizations and state agencies all need to receive, process, analyse and share data collected at the local level on quality-of-life indicators, progress of development programmes, and new opportunities for, and challenges to, achieving further impetus to technical learning and improvement in regions characterized by low-income populations. Furthermore, the international community must take a leadership role in monitoring technological progress in those areas likely to yield benefits to poor communities.[33]

Participation

39. When poor populations are introduced to technologies, the chances for successful outcomes are improved markedly when the prospective users are directly involved in the process of selecting adequate technologies, properly adapting them to prevailing economic activities and conditions, disseminating the technologies among themselves, and mastering and improving on them. It is recommended that agents responsible for upgrading technologies and skills in poor communities build a strong participatory dimension into such programmes.[34]

40. Participation in a more general sense could have equally important beneficial effects with respect to low-income people's innovativeness, incentives to risk experiments with new technologies and their ability to recognize opportunities inherent in market-oriented national and international economies. When poor populations are politically impotent and socially marginalized, all of the foregoing attributes are severely diminished. The keys are political empowerment and greater social integration of poor populations; closely associated with these objectives is greater decentralization of government towards increased local decision-making. As one report on human development observed: "Greater people's participation has become an imperative, a condition of survival."[35] One of the most effective avenues for fostering participation by the poor is the decentralization of state functions, thus freeing, indeed obliging, local communities to engage in problem-solving activities and in the formulation and execution of development policies. It is important that Governments recognize the political, economic and social benefits flowing from decentralized governance, empowerment and social integration of poor populations and so implement actions supporting these objectives. Particular attention and special effort should be devoted to encouraging participation of both men and women. While a role is to be played by all levels of actors in achieving these objectives, the linchpin is the engagement of intermediate and fundamental non-governmental organizations that can assist local organizations in attempting to solve their own problems. This fits comfortably with the emphasis given by the World Summit for Social Development to the goal of social integration, on the agenda of its session to be held in Copenhagen in March 1995.

Health

41. Health is basic for being independent and becoming more productive, and for people taking direct responsibility for their own development. In fact, health, sanitary conditions and, accordingly, life expectancy are fundamental indicators of basic needs satisfaction. It is important to emphasize that health, together with education, housing and food, are determining factors of the social position of low-income populations. Health problems of these populations show a specific pattern related to deficiencies and hazards originating from poverty. Some one billion people live without adequate water and sanitation, and this is the cause of many of the most prevalent diseases in developing countries. Many health problems can be prevented, diagnosed and treated with available, relatively simple and affordable equipment, and work in the field of sanitation and waste management through promotion of technologies affordable by low-income communities, as well as that promoting technology development in vaccines and diagnostics is proving to be critical. HABITAT and UNIDO have been active in these fields.[36] At the same time, recent technology based on physical and engineering sciences has provided new health-care devices and techniques. However, many of these technologies are complex, costly and technically demanding, particularly for developing countries. Their effective introduction, use and maintenance requires sophisticated managerial, medical and engineering talent, and points to the need to evaluate health priorities and allocate scarce resources. In the specific context of basic needs, WHO's efforts to provide guidance on essential equipment for health facilities and to strengthen national capacities for the use of health technology as integrated components of overall health systems development are of particular importance. Such efforts require sustained support by all of the international community.

Basic infrastructure

42. Basic physical infrastructure constitutes another critical "pillar" supporting the bridge between basic needs deficiency and prosperity, providing an atmosphere in which innovative behaviour can be meaningful, and facilitating the attainment of necessary inputs and the marketing of products. Many of the methods for providing basic infrastructure are already on the "technology shelf"; it is mainly a question of giving infrastructure the priority and commitment that it deserves. Special attention should be directed to such considerations as ease of obtaining water and fuel. This for example can reduce or eliminate the burdens falling disproportionately on women. It is recommended that very high priority be accorded to the provision of basic infrastructure to poor populations. Clearly, in this area the responsibility often rests with the State, but donors, especially those supporting least developed countries, can be extremely helpful in influencing priorities. Since infrastructure is almost always construction-intensive, there may be scope for utilizing local resources including income-generating employment of unemployed or underemployed members of the local labour force. In this respect, local and regional agencies can serve a useful function. In addition, longer-term efforts might focus on feasibility studies investigating the viability of large-scale science-cum-engineering projects. More ambitious projects in this respect have included water diversion schemes.

Small-scale economic activities

43. Small-scale economic activities will, for the foreseeable future, constitute the primary source of employment and income for poor populations; this alone renders such activities critical in terms of the pillars of the bridge between unmet basic needs and prosperity. There is now ample evidence that small loans to low-income entrepreneurs starting or operating a micro and/or small enterprise can be made available on commercial terms or with a very modest subsidy. Governments without adequate methods for financial delivery to these enterprises could initiate such a programme after careful investigation of the experiences of countries with such mechanisms in place. The primary impetus must be at the national level, although international actors can be instrumental in conducting evaluative case-studies of credit delivery to low-income entrepreneurs in developing countries; non-governmental organizations might be useful as a conduit and screening agency between the centrally provided credit and the borrowers.

44. However unintentional, certain macroeconomic policies frequently have deleterious effects on both labour-intensive production techniques and smaller enterprises." Given the importance of the informal sector, Governments should consider ways to reduce antagonism between players in the informal sector, the formal sector and the State. Monetary and fiscal policies, as well as policies affecting trade, exchange rates, pricing, labour and wage regulations, can be biased against micro and small and medium-sized enterprises. Given this possibility, it may benefit nations with poor populations to examine systematically their policy framework and take measures to address any unwarranted disincentives to the promotion of the micro and small/medium-sized sector. Other aspects are also critical, particularly technical assistance, including assistance for identifying promising projects, preparing feasibility studies, organization and management of an enterprise, the process of selecting technologies and using them efficiently, quality control, means of transportation, and marketing. The advisability of regulatory provisions hampering the technical progress of enterprises in the informal sector should come under close critical scrutiny. While the national level is the prime mover, technical assistance from international agencies should be available as needed.

45. While all such measures could be implemented in fairly short order, in the long-run, however, technological progress is necessary, especially in emerging technologies amenable to achieving viable technology blends with traditional production methods. Particularly promising in this respect are: new biotechnological innovations that tend to be scale-neutral; new materials that

can be inputs for small manufacturers; nutritional enhancement of oral rehydration salts; new methods of direct casting and thin films for photovoltaics; long-range meteorological predictions of drought conditions; and information technologies suitable for poor communities. The international community could encourage research and development to promote such emerging technologies and conduct experiments leading to their integration with traditional, low-income, small-scale activities. In general, efforts concentrating on replicating programmes that work effectively to support micro and small/medium-sized enterprises could do a great deal to satisfy basic needs.

B. Summary recommendations for action

46. Despite the fact that the complete picture of poverty alleviation is complex, and though the accomplishment of the goal of alleviating poverty constitutes a serious challenge, the statement of the fundamental objective of the technological facet of the problem can be formulated very succinctly: **to create participatory conditions that increase the ability of the poor in the generation, access, comprehension and utilization of technology in order to satisfy their basic needs.** Clearly, there is considerable interaction and complementarity among all of the six bridging elements identified in the report and concerning technology and basic needs. It is highly desirable that these elements be introduced in concert rather than in isolation. Recommendations for action on these elements and on fundamental science and technology policy for addressing basic needs follow:

1. Education

(a) Considerable evidence attests to high rates of returns—both in monetary terms and in various indirect social benefits—accruing to expenditures on education. This is especially so for women and for primary basic education. It is therefore recommended that science- and technology-based education be considered a cornerstone of a strategy to meet basic needs.

(b) Although an entire range of curricula, topics, and emphases can be involved in the provision, the following should be considered essential to the cause of alleviating basic needs shortfalls: (i) education for increasing production and productivity of small-scale economic activities; (ii) education enabling the poor to relate to their environment and to participate effectively and constructively in community life; (iii) education enabling the poor to put into practice policies and programmes of preventive medicine that is indispensable for improving their levels of health and nutrition; (iv) education for the poor that will provide impetus to a process of sustainable development, one that will preserve and protect the environment.

(c) State-of-the-art technology-assisted education and vocational training should be seriously considered.

(d) Countries should be encouraged to review their expenditures on education in terms of the allocation between primary, secondary and higher education, geographic configuration and gender equity, in order to determine if the investment is consonant with optimal social returns and basic needs considerations.

(e) The United Nations should promote and sponsor a conference to sensitize the scientific and technological community and policy and decision-makers to the issue of the contribution of science and technology for the satisfaction of basic needs.

2. Access to information

(a) Information must be accessible by poor populations for general education purposes, to further participatory action leading to empowerment and to support small-scale enterprises attempting to gain knowledge concerning applications for credit, diversification of product, market conditions, product specification,

price and availability of inputs, transportation alternatives and schedules, and alternative production techniques. Efforts should also be made to assist the poor in accessing existing information sources in structured and intelligible forms that are useful for basic needs satisfaction.

(b) The scientific and technological community should be encouraged to initiate participatory exploration with targeted low-income groups in order to identify priority information needs and to facilitate access to such information.

(c) Through periodic review of basic needs programmes, decision-makers must get information on the incidence of "hijacking" whereby the non-poor are benefiting inordinately from such programmes while objectives related to filling basic needs deficits are not being met.

(d) The international community can make major contributions by collecting and disseminating information related to overall efforts to satisfy basic needs: (i) monitoring the most significant basic needs indicators for the world's poor populations; (ii) offering a "one- stop" referral service in information networks; (iii) providing monitoring and alerting mechanisms regarding new technological outputs that are particularly promising for satisfying basic needs.

3. Participation

(a) It is recommended that in technology-related projects geared towards bettering the lot of poor populations every effort be made to involve the target group fully at every stage.

(b) More generally, support for participatory actions leading to the empowerment of the ultra-poor to affect the political, economic and social aspects of their lives is justified for intrinsic reasons, and also because participatory-driven empowerment can create an atmosphere more conducive to innovative behaviour.

4. Health

(a) Countries should be encouraged to give greater emphasis to preventive *versus* curative health measures.

(b) Countries should review the geographic configuration and gender equity of their health programmes, in order to determine if the investment as constituted is consonant with optimal social returns and basic needs considerations.

5. Basic infrastructure

(a) Basic physical infrastructure is a requisite for supporting the other "pillars" of the bridge leading from poverty to prosperity. Primary responsibility rests with the State, but donors can also be effective in providing adequate supplies of safe water, energy, sewage and other sanitation facilities, transportation grids and means of communication.

(b) Since such basic infrastructure is often construction-intensive, every effort should be made to mobilize local resources, including income-generating employment, in the provision of facilities.

6. Small-scale economic activities

(a) Governments without adequate methods for financial delivery to micro/small and medium-sized enterprises should consider seriously the initiation of such a programme after careful perusal and consideration of the experiences of countries with such mechanisms in place.

(b) Often, however unintentional, macroeconomic policies can have deleterious effects on labour-intensive production techniques and/or smaller enterprises.

Therefore, it is recommended that nations undertake a meticulous and systematic review of each major component of their macroeconomic policy framework and take measures to address any unwarranted disincentives for a vital and progressive micro/small/medium-sized productive sector.

(c) Governments should recognize the contributions of the informal sector as a repository of employment, in generating income, and frequently, as a source of innovation. Means should be explored for technically upgrading informal activities, increasing "graduation" rates to the formal sector and reconciling frictions between the informal sector, formal sector and the State.

(d) The scientific and technological community should be encouraged to take the initiative in linking, in a participatory fashion, technologies with smaller-sized entrepreneurs.

7. The foundation: Recommendations for action concerning science and technology policy for basic needs

(a) In view of inadequate existing poverty programmes, new technological means for addressing basic needs, and the sweeping economic, political and social transformations in the global landscape, it is proposed that the United Nations adopt the issue of technology for basic needs as an agenda of concern. The United Nations should implement a mechanism for the evaluation of national science and technology policies with the aim of determining how adequately basic needs satisfaction is being addressed. Countries should be exhorted to build into their science and technology strategies a major component addressing basic needs.

(b) It is recommended that nations carefully and comprehensively survey existing technical assistance, extension services and other programmes that support technological upgrading of small- and medium-sized enterprises and adopt those that seem suitable to their own circumstances.

(c) Attention should be directed towards strengthening of networking of science and technology institutions and enterprises of both private and public sectors, at the national and international levels.

(d) A pilot programme should be developed for science and technology for basic needs, involving different countries from diverse regions. If this recommendation is accepted, the Commission on Science and Technology for Development should establish a Board on Technology and Basic Needs. The functions of the Board shall be to: (i) examine the overall approach and feasibility of implementing the programme; (ii) identify participating countries, formulate an operational programme and budget, and find the necessary financial resources for its implementation; and (iii) report on these activities to the Commission on Science and Technology for Development at its third session.

(e) It is recommended that technology for basic needs be addressed in a series of sessions involving participation by the Commission on Science and Technology for Development (CSTD). It is also recommended that a joint session of CSTD and the Commission on Human Rights be held.

Notes

1. See *Review of the Work of the United Nations System and Selected Organizations Dealing with Technologies for Basic Needs* (UNCTAD/DST/Misc.14-TECH/BASE/7).

2. See Frances Stewart, *Basic Needs in Developing Countries*, Baltimore, Maryland, the John Hopkins University Press, 1985.

3. See paper by S.L. Yampolsky, "Main Directions to Preserve and to Develop the Internal Scientific and Technological Potential in Ukraine - Vocational Training in Ukraine" (TECH/BASE/12).

4. UNCTAD, *The Least Developed Countries 1993-1994 Report*, New York and Geneva, United Nations, 1994.

5. United Nations, *Report on the World Social Situation 1993*, New York, United Nations, 1993.

6. *Ibid.*

7. Inter-American Development Bank and UNDP, *Reforma social y pobreza: Hacia una agenda integrada de desarollo* (in Spanish), Washington, DC, IDB, 1993.

8. World Bank, *Implementing the World Bank Strategy to Reduce Poverty*, Washington, DC, World Bank, 1993.

9. According to *The Economist*, "since 1979 real income of the poorest 10 per cent has fallen in real terms while average income of the whole population rose by 25 per cent and that for the top 10 per cent of the population expanded by 50 per cent", *The Economist*, 4 June, 1994.

10. See papers by: G. Yiemene, "Science and Technology Policy Initiatives to Address the Basic Needs of Low Income Population in Ethiopia" (TECH/BASE/13); M. Gbeassor, "Experiences in Togo" (TECH/BASE/10); and S.P. Kagoda, "Profiles of On-going Projects in Uganda which Attempt to Address the Needs of Low-income Populations" (TECH/BASE/11).

11. See paper by A. Ventura and M.E.D. Henry, "Technology for Basic Needs: the Forgotten Strategy" (TECH/BASE/17).

12. See also papers by O. Serrate, "Ciencia para el desarrollo humano sostenible, tecnologías para los derechos vitales" (in Spanish) (TECH/BASE/21) and "Science for Sustainable Development, Technologies for Vital Rights" (TECH/BASE/21/Add.1) (unedited version in English), and by G. Fernández, "Technology and Basic Needs: Notes for Policy Guidelines" (TECH/BASE/22).

13. See S. Lall, *et al*, 1994.

14. C. Maldonado and S.V. Sethuraman (eds.), *Technological Capability in the Informal Sector*, Geneva, International Labour Office, 1992.

15. See paper by Dilmus D. James, "Basic Needs - Old Imperatives - Fresh Approaches" (TECH/BASE/18).

16. The work that gave intermediate (later designated "appropriate") technology a strong following was that of E.F. Schumacher, *Small Is Beautiful: Economics as if People Mattered*, London: Blond and Briggs Ltd., 1973. For early reviews of appropriate technology, see, for example, H.W. Singer, *Technology for Basic Needs*, International Labour Office, 1972; UNIDO, *Conceptual and Policy Framework for Appropriate Industrial Technology. Monograph on Appropriate Industrial Technology*, No 1, 1979, and N. Jequier and

G. Blanc, *The World of Appropriate Technology*, Paris, OECD, 1983. The most exhaustive review and evaluation of the concept of appropriate technology is by K.W. Willoughby, *Technology Choice: A Critique of the Appropriate Technology Movement*, Boulder, Colorado, Westview, 1990. On the latter aspect, see also R. Bhagavan, *A Critique of "Appropriate" Technology for Underdeveloped Countries*, Uppsala, Sweden, The Scandinavian Institute of African Studies, 1979.

17. See paper by Mikoto Usui, "Newly Emerging Technologies for Blending with Traditional Technologies" (TECH/BASE/25 and Add.1).

18. See, for example, E.U. von Weizsacker, M.S. Swaminathan and A. Lemma (eds.), *New Frontiers in Technology Application: Integration of Emerging and Traditional Technologies*, Dublin, Tycooly International Publishers, 1983; A.S. Bhalla, D.D. James and Yvette Stevens (eds.), *Blending of New and Traditional Technologies: Case Studies*, Dublin: Tycooly International Publishers, 1984; A.S. Bhalla and D. James (eds.), *New Technologies and Development: Experiences in Technology Blending*, Boulder, Colorado, Lynne Rienner, 1988; and U. Colombo and K. Oshima (eds.), *Technology Blending: An Appropriate Response to Development*, London, Tycooly, 1989.

19. See D. James, *op cit.* Current technology blending efforts include the application of microelectronic innovations to traditional small-scale manufacturing in Latin America, "biovillage" and information village projects in India, a variety of projects being implemented in Malaysia, and the development of artificial intelligence software suitable to solving the problems and conditions of developing countries.

20. See Ajit Singh, *Basic Needs and Development Programme. Industrialization, Employment and Basic Needs in a Fast-growing Agrarian State: a Study of the Indian Punjab*, World Employment Programme Research, Working Papers, ILO, 1983.

21. See Ajit S. Bhalla and Amulya K.N. Reddy, *The Technological Transformation of Rural India* (a study prepared for the International Labour Office within the framework of the World Employment Programme), London, Intermediate Technology Publications, 1994.

22. In various case-studies contained in the volume referred to, it is recognized that markets and competition will increasingly provide a framework for more effectively organizing the production and distribution of these goods and services. A synthesis is required for fully harnessing the advantages of the market as a way of overcoming its limitations, for example equity-blindness, its environmental "externalities" and its preoccupations with the short term.

23. While a battery of policy measures had been in operation for nearly 40 years in India, the authors affirm that this had not led to rapid growth and technological transformation of the rural sector. A number of reasons explain this, including the fact that various measures took the form of hidden subsidies, which may have discouraged innovation. One of the primary objectives of the policy measures was social welfare and employment; thus, governmental policies had been much less development-oriented than desirable.

24. See H. Szretter, *Planning for Basic Needs in Latin America. Mexico: las necesidades básicas de alimentación*, Institute of Social Studies, ILO, PREALC, 1985.

25. Rudolf Teekens (ed.), *Theory and Policy Design for Basic Needs Planning: A Case-Study of Ecuador*, The Hague, 1988.

26. It is further stated that "in the case of milk and dairy products, small-scale rural industries may play an important role in rural income and employment generation, but modern small-scale and large-scale industries would be needed to provide adequate supplies of dairy products to satisfy a target level of domestic demand.... In other sectors, modern small-scale industry could function at an intermediate technology level where growth and employment objectives are reconciled. Such options exist in both basic consumer goods (e.g. processed meat, milking products, dairy products, clothing and shoes) and in intermediate goods industries (e.g. textiles, leather, wood, metal products)". R. Teekens (ed.), *op. cit.*, pp. 334-335.

27. Fernando Villarán de la Puente, *Innovaciones tecnológicas en la pequeña industria*, Lima, Fundación Friedrich Ebert, 1989 (in Spanish).

28. Within the context of the Technology Policy Group of the Junta del Acuerdo de Cartagena, and under the responsibility of Salazar de Buckle of the Andean Technological Development Projects, the final products resulting from this experience were commercialized under the name "Chicolac". See Gustavo Flores Guevara, "Transfer and Adaptation of a Technology of Milk Substitutes Production in the Andean Group: a Bolivian Case-study", in *Research and Development: Linkages to Production in Developing Countries*, Mary Pat Williams-Silveira (ed.), published in cooperation with the United Nations Centre for Science and Technology for Development, Boulder, Colorado and London, Westview Press, 1985.

29. See data cited in UNCTAD, *The Least Developed Countries, 1993-1944 Report*, New York and Geneva, United Nations, 1994, p. 126.

30. *Ibid.*, p. 127.

31. For example, about 40 per cent of personal income inequality in Brazil is related to education. See Jere R. Behrman, "Investing in Human Resources", in IDB, *Economic and Social Progress in Latin America: 1993 Report*, Washington, DC, IDB, 1993, pp. 187-255.

32. For an example of a successful urban delivery system in Ghana, see ILO, *Entrepreneurship and Small Enterprise Development in Urban and Rural Sectors in Africa*, Geneva, ILO, 1993; also, for a description of a more ambitious, experimental "biovillage" in India, see M.S. Swaminathan Foundation, *Third Annual Report. 1992-93*, Madras, the Foundation, 1993.

33. A great deal of the necessary information routinely appears in UNDP's annual *Human Development Report*. UNCTAD's *ATAS Bulletin* could devote an issue entirely to monitoring scientific and technological undertakings or outputs that hold significant promise for satisfying basic needs.

34. See, in this context, chapter III, section B, "Building a Commitment to Technological Change" in UNCTAD document *Transfer and Development of Technology in the Least Developed Countries: an Assessment of Major Policy Issues* (UNCTAD/ITP/TEC/12). From the case studies presented in this document, it would appear evident that planners and policy-makers in donor countries and host Governments at national, regional and local levels must deliberately encourage and facilitate such a participation process.

35. UNDP, *Human Development Report, 1993*, New York, Oxford University Press, 1993, p. 99.

36. See *Review of the Work of the United Nations System and Selected Organizations Dealing with Technologies for Basic Needs* (UNCTAD/DST/Misc.14-TECH/BASE/7), pp. 7, 14-16, 28-30.

37. See Frances Stewart (ed.), *Macro-policies for Appropriate Technology in Developing Countries*, Boulder, Colorado, Westview, 1987 and Frances Stewart, Henk Thomas and Ton de Wilde (eds.), *The Other Policies: The Influence of Politics on Technology Choice and Small Enterprise Development*, London, Intermediate Technology Publications, 1990.

ANNEX I

List of participants in the Panel on Technology for Small-scale Economic Activities to Address the Basic Needs of Low-income Populations

Mr. Oscar Serrate
Chairman of the Commission on Science and Technology for Development
Bolivia

Mr. Geoffrey Oldham
Science and Technology Adviser to the President
International Development Research Centre (IDRC)
Canada

Mr. Niels E. Busch
Carl Bro Energy and Supply, Ltd
Denmark

Mr. Getaneh Yiemene
Head, Science and Technology Policy and Planning Department
Ethiopian Science and Technology Commission
Addis Ababa - Ethiopia

Mr. Mussie Delelegn
First Secretary
Permanent Mission of Ethiopia
Geneva

Mr. Arnoldo Ventura
Special Adviser to the Prime Minister on Science and Technology
Office of the Prime Minister
Jamaica

Mr. Mikoto Usui
Faculty of Policy Management
Keio University (SFC)
Japan

Mr. Fauzi El Mugassabi
Counsellor
Permanent Mission of the Libyan Arab Jamahiriya
Geneva

Mr. George M. Mhango
University of Malawi
Malawi

Mr. J. George Waardenburg
Chief Scientist
Ministry of Foreign Affairs
The Netherlands

Mr. Messanvi Gbeassor
Doyen, Faculté des sciences
Université du Bénin
Togo

Mr. S.P. Kagoda
Director of Industry and Technology
Ministry of Trade and Industry
Uganda

Mr. Serguei Yampolsky
Head, Department of International Cooperation
State Committee on Science and Technologies
Ukraine

Consultants

Mr. Gustavo Fernández
Bolivia

Mr. Dilmus James
University of Texas at El Paso
Department of Economics and Finance
USA

International Organizations

Mr. Mihael Zinovieff
Deputy Head, Geneva Office
United Nations Department
for Development Support
and Management Services
Geneva

Mr. Lowell Flanders
Chief of Branch
Division for Sustainable
Development
United Nations Department
for Policy Coordination
and Sustainable Development
New York

Mr. Morton Satin
Chief, Food and Agricultural
Industries Service
Agricultural Services Division
Food and Agriculture Organization
of the United Nations
Rome

Mr. Ajit Bhalla
Chief, Employment Strategies
and Policies Branch
Employment Department
International Labour Office
Geneva

Mr. I. Ahmed
Employment Strategies and
Policies Branch
Employment Department
International Labour Office
Geneva

Mr. P. Malhotra
Officer-in-Charge
UNESCO Liaison Office
in Geneva

Mr. Souren Seraydarian
Director
UNIDO Liaison Office
in Geneva

Mr. A. Akpa
Liaison Officer
UNIDO Liaison Office
in Geneva

Mr. B. Mansourian
Director, Office of Research
Policy and Strategy Coordination
World Health Organization
Geneva

Mr. J. Szczerban
Scientific Adviser
Office of Research Policy
and Strategy Coordination
World Health Organization
Geneva

Mr. Y. Maruyama
Scientist
Office of Research Policy
and Strategy Coordination
World Health Organization
Geneva

UNCTAD secretariat

Mr. Pedro Roffe
Officer-in-Charge
Division for Science
and Technology

Ms. Gloria-Veronica Koch
Chief, Capacity Building Section
Division for Science
and Technology

Mr. Vladimir Pankov
Economic Affairs Officer
Division for Science
and Technology

Mr. Dieter Koenig
Scientific Affairs Officer
Division for Science
and Technology

Mr. Taffere Tesfachew
Economic Affairs Officer
Division for Science
and Technology

Mr. Maurizio Dal Ferro
Economic Affairs Officer
Division for Science
and Technology

ANNEX II

Experts having contributed to the work of the Panel as "Friends of the Chairman"

Mr. Fernando Antezana
Assistant Director General
World Health Organization
Geneva

Mr. M.R. Bhagavan
Natural Sciences, Technology and Industrialization
Swedish Agency for Research Cooperation with Developing Countries (SAREC)
Sweden

Mr. Ajit Bhalla
Chief
Employment Strategies and Policies Branch
Employment Department
International Labour Office
Geneva

Mr. Claes Brundenius
Research Policy Institute
University of Lund
Sweden

Mr. Dilmus James
University of Texas at El Paso
Department of Economics and Finance
USA

Ms. Teresa Salazar de Buckle
Austria

Mr. M. S. Swaminathan
M.S. Swaminathan Research Foundation
India

Mr. Mohamed S. Zehni
Director
Research and Technology Development Division
Food and Agriculture Organization of the United Nations
Rome

Mr. Carlos Maria Correa
Director, Maestria en Politica y Gestion C. y T.
Centro de Estudios Avanzados (CEA)
Universidad de Buenos Aires
Argentina

Mr. Mihaly Simai
Acting Director
United Nations University/World Institute for Development Economics Research
Finland

Mr. Sam Lanfranco
Associate Professor, Economics
York University
Canada